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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/827,187	04/19/2004	Farshad A. Bavarian	X-0170	2434

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EXAMINER
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MERKLING, MATTHEW J

ART UNIT	PAPER NUMBER
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1764

MAIL DATE	DELIVERY MODE
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09/28/2007

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

**Application No.**

10/827,187

**Applicant(s)**

BAVARIAN ET AL.

**Examiner**

Matthew J. Merkling

**Art Unit**

1764

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 19 April 2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) 1-16 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 17-30 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date 5/13/04, 7/22/04.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Election/Restrictions***

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
  - I. Claims 1-16, drawn to an apparatus for generating hydrogen, classified in class 48, subclass 127.9.
  - II. Claims 17-30, drawn to method for generating hydrogen-rich reformat, classified in class 48, subclass 197R.

The inventions are distinct, each from the other because of the following reasons:

2. Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another and materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus as claimed can be used to practice another and materially different process such as one that incorporates a gas shift catalyst in the catalyst bed.
3. During a telephone conversation with Melissa Patangia on 9/20/07 a provisional election was made without traverse to prosecute the invention of Group II, claims 17-30. Affirmation of this election must be made by applicant in replying to this Office action. Claims 1-16 withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.
4. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one

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or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. Claims 17, 20, 21, 23-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stevens (US 2002/0155329) in view of Monzyk et al. (US 6,503,298).

Regarding claims 17, Stevens discloses a method for generating a hydrogen-rich reformat (see abstract), the method comprising the steps of:

reacting a hydrocarbon fuel in a catalyst bed (41,42) comprising a reforming catalyst and carbon dioxide fixing material (paragraph 0007, lines 1-6) to produce a reformat comprising hydrogen and carbon dioxide, the carbon

dioxide fixing material fixing at least a portion of the carbon dioxide in the reformat to produce an intermediate reformat (paragraph 7, lines 10-12).

While Stevens discloses a hydrogen generation process from a reforming unit for use in a fuel cell, Stevens fails to explicitly disclose the steps of:

- removing hydrogen from the intermediate reformat by flowing the intermediate reformat through a first purification bed comprising a hydrogen fixing material to produce a hydrogen-depleted gas and fixed hydrogen; and releasing the fixed hydrogen from the first purification bed to produce a

hydrogen-rich gas;

- claim 21- removing heat from the first purification bed;

- claim 23 - interrupting flow of a feed gas;

- claim 24 – purging the first purification bed to remove hydrogen-depleted gas prior to releasing the fixed hydrogen;

- claim 25 – the hydrogen fixing material comprises a metal hydride;

- claim 26 – the fixed hydrogen is released from the first purification bed by imposing a change in temperature on the hydrogen fixing material;

- claim 27 – diverting the feed from the first purification bed and flowing the feed through a second purification bed;

- claim 28 – wherein the fixed hydrogen is released from the first purification bed while the feed flows through the second purification bed;

- claim 29 – wherein fixed hydrogen is released from the first purification bed by heating the hydrogen fixing material within the first purification bed with heat derived in part from the second purification bed, and

-claim 30 – releasing fixed hydrogen from the second purification bed by imposing a change in temperature on the hydrogen fixing bed.

Monzyk discloses a preferable hydrogen purification unit that can be used downstream of a reformer (as used in Stevens) and used to produce hydrogen for a fuel cell (col. 18 lines 11-24).

Monzyk teaches a method of purifying hydrogen for a fuel cell comprising the steps:

-removing hydrogen from the intermediate reformat by flowing the intermediate reformat through a first purification bed (sorption state, Fig. 11) comprising a hydrogen fixing material (metal hydride, see claim 23 of Monzyk) to produce a hydrogen-depleted gas and fixed hydrogen (col. 2 lines 32-42); and

-releasing the fixed hydrogen from the first purification bed to produce a hydrogen-rich gas (col. 2 lines 52-55).

-claim 21- removing heat from the first purification bed (thermal swing sorption, col. 5 lines 26-31, see cool water stream in Fig. 11).

-claim 23 - interrupting flow of a feed gas (feed switching during temperature swing cycles, col. 19 line 66 – col. 20 line 3).

-claim 24 – purging the first purification bed to remove hydrogen-depleted gas prior to releasing the fixed hydrogen (see purge step in Fig. 9a).

-claim 25 – the hydrogen fixing material comprises a metal hydride (see claim 23 of Monzyk).

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-claim 26 – the fixed hydrogen is released from the first purification bed by imposing a change in temperature on the hydrogen fixing material (col. 2 lines 52-55).

-claim 27 – diverting the feed from the first purification bed (sorption state, see Fig. 11) and flowing the feed through a second purification bed (desorption state, see Fig. 11, this is part of the thermal swing process described by Monzyk, col. 2 lines 32-65, col. 19 line 66 – col. 20 line 3).

-claim 28 – wherein the fixed hydrogen is released from the first purification bed while the feed flows through the second purification bed (see desorption and sorption steps of Fig. 11, col. 2 lines 32-65, col. 19 line 66 – col. 20 line 3).

-claim 29 – wherein fixed hydrogen is released from the first purification bed by heating the hydrogen fixing material within the first purification bed with heat derived in part from the second purification bed (col. 17 lines 38-45, Fig. 8).

-claim 30 – releasing fixed hydrogen from the second purification bed by imposing a change in temperature (heatup) on the hydrogen fixing bed (thermal swing cycle, as described above, col. 2 lines 32-65, col. 19 line 66 – col. 20 line 3).

Monzyk teaches this process as an efficient and preferable way of purifying hydrogen (col. 21 lines 17-24). Furthermore, Stevens discloses the preference for high purity hydrogen for the efficient operation of a fuel cell and lower cost (see paragraph [0006] of Stevens). As such, it would have been obvious to one of ordinary skill in the art at the time of the invention to add the hydrogen purification process of Monzyk to the hydrogen generating process of Stevens in

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order to provide high purity hydrogen in an efficient way for uses such as in fuel cells.

Regarding claim 20, Stevens, as discussed in claim 17 above, further discloses a water gas shift catalyst contained in the catalyst bed (paragraph [0026] lines 11-19).

8. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Stevens (US 2002/0155329) in view of Monzyk et al. (US 6,503,298), as applied to claim 17 above, and further in view of Golben (US 5,250,368).

Regarding claim 18, modified Stevens, as discussed in claim 17 above, teaches the use of metal hydrides to adsorb/store hydrogen in the first purification bed, but fails to teach removal of water from the reformat stream prior to entry into the first purification bed.

Golben also teaches a metal hydride employed to store/adsorb hydrogen (see abstract).

Golben teaches that water is preferably removed from the hydrogen stream (20) prior to entry into the metal hydride storage vessel (50) as water is damaging to metal hydride and can decrease the adsorbing efficiency of the metal hydride (col. 5 lines 59-67 and col. 6 lines 5-15).

It would have been obvious to one of ordinary skill in the art at the time of the invention to add the water removal step of Golben, into the hydrogen generating process of modified Stevens prior to the purification bed (which



comprises metal hydride) in order to prevent the destruction of the metal hydride and the reduction in adsorbing efficiency of the metal hydride.

9. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Stevens (US 2002/0155329) in view of Monzyk et al. (US 6,503,298), as applied to claim 17 above, and further evidenced by Heung (US 5,958,098).

Regarding claim 19, modified Stevens, as discussed in claim 17 above, further discloses a methanation step (44, paragraph [0034]). Moreover, it would have been obvious to place the methanation step of the modified Stevens prior to the first purification bed in order to remove carbon monoxide which is known in the art to be a poison to metal hydrides (see Heung, col. 1 lines 34-38).

10. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Stevens (US 2002/0155329) in view of Monzyk et al. (US 6,503,298), as applied to claim 17 above, and further evidenced by Schiodt et al. (US 2001/0055560).

Regarding claim 22, Stevens, as discussed in claim 17, fails to disclose the step of monitoring the hydrogen-depleted gas.

Schiodt also teaches a method for producing hydrogen rich gas (see title).

Schiodt teaches a chromatograph that continuously monitors the effluent from a hydrogen producing reactor as a way to monitor the effect of the catalyst, as in determining when it is becoming deactivated (paragraph [0037]).

It would have been obvious to one of ordinary skill in the art at the time of the invention to add the composition monitoring step of Schiodt to the hydrogen

generation process of modified Stevens in order to monitor the performance of the catalyst to determine when deactivation takes place.

### **Conclusion**

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Merkling whose telephone number is (571) 272-9813. The examiner can normally be reached on M-F 8:30-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn Caldarola can be reached on (571) 272-1444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



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